Active Project (2015 - 2017)

High Pressure Oxygen Generation for Future Exploration Missions, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

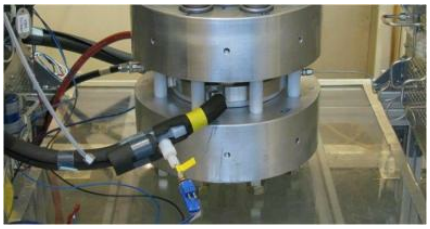
ABSTRACT

The proposed innovation is the development of a cathode feed electrolysis cell stack capable of generating 3600 psi oxygen at a relevant scale for future exploration missions. This innovation is relevant to NASA's need for compact, quiet, efficient, and long-lived sources of pressurized oxygen for atmosphere revitalization (AR) and EVA oxygen storage recharge. Present AR equipment aboard International Space Station (ISS) consists of power-intensive, noisy compressors that have service lives less than 2 years. Proton's proposed electrolyzer stack will eliminate the need for these compressors, by developing a cell stack that can produce 3600 psia oxygen via electrochemical compression. This innovation results in a quiet, efficient, solid state device with no internal moving parts to service or fail.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Based on Proton's unique experience in commercializing PEM electrolyzers, transitioning to NASA, DOD, and developing commercial applications are important outcomes of this technology development effort. The NASA applications for this technology are several: providing pressurized oxygen refill capability to a number of scenarios including ISS, EMU, and future lunar surface systems. Civilian commercial derivatives of this technology would enable a variety of energy storage applications. High pressure electrolysis provides the key capability for volumetrically dense hydrogen and oxygen storage. Impacts of this technology on military operations include enabling high altitude unmanned aerial vehicle operations and a variety of underwater vehicle operations, most notably UUV's. The similarity between the high altitude and undersea applications is that both require the storage of oxidant, in addition to the storage of fuel. High altitude UAV's can be used for missile defense, surveillance, and communications.



High Pressure Oxygen Generation for Future Exploration Missions

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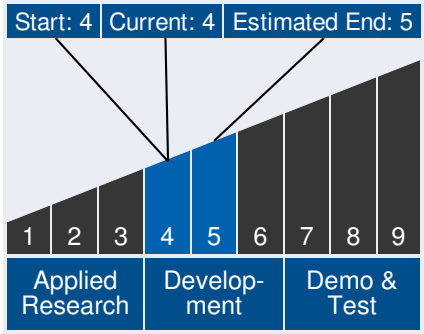
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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Undersea applications include long-term distributed data gathering with long endurance buoys, transport of special forces personnel, and mine neutralization among others. In short, the proposed effort will support the development of an enabling technology for a variety of applications that require high pressure hydrogen and/or oxygen for energy storage and life support.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The proposed technology will also enable commercial regenerative fuel cell (RFC) systems, which will benefit from high pressure electrolysis for compact reactant storage. Proton is working to commercialize RFC systems for a variety of terrestrial energy storage applications. In particular, Proton's RFC technology has been demonstrated as a replacement for lead acid batteries in telecom backup power systems. This solution provides both ride-through capability and rapid response characteristics at a lower life cycle cost than battery technology. A natural extension of backup power is the integration of RFC's with inherently intermittent renewable energy sources. Additional massive and undeveloped markets are emerging as higher penetration of renewables causes grid balancing and regulation challenges. Small scale power generation and energy storage will become another distributed technology analogous to cell phones for communications.

Management Team *(cont.)*

Principal Investigator:

- Luke Dalton

Technology Areas

Primary Technology Area:
Human Health, Life Support, and Habitation Systems (TA 6)
└ Environmental Control and Life Support Systems and Habitation Systems (TA 6.1)
  └ Air Revitalization (TA 6.1.1)
    └ High-Pressure Oxygen Supply (TA 6.1.1.7)

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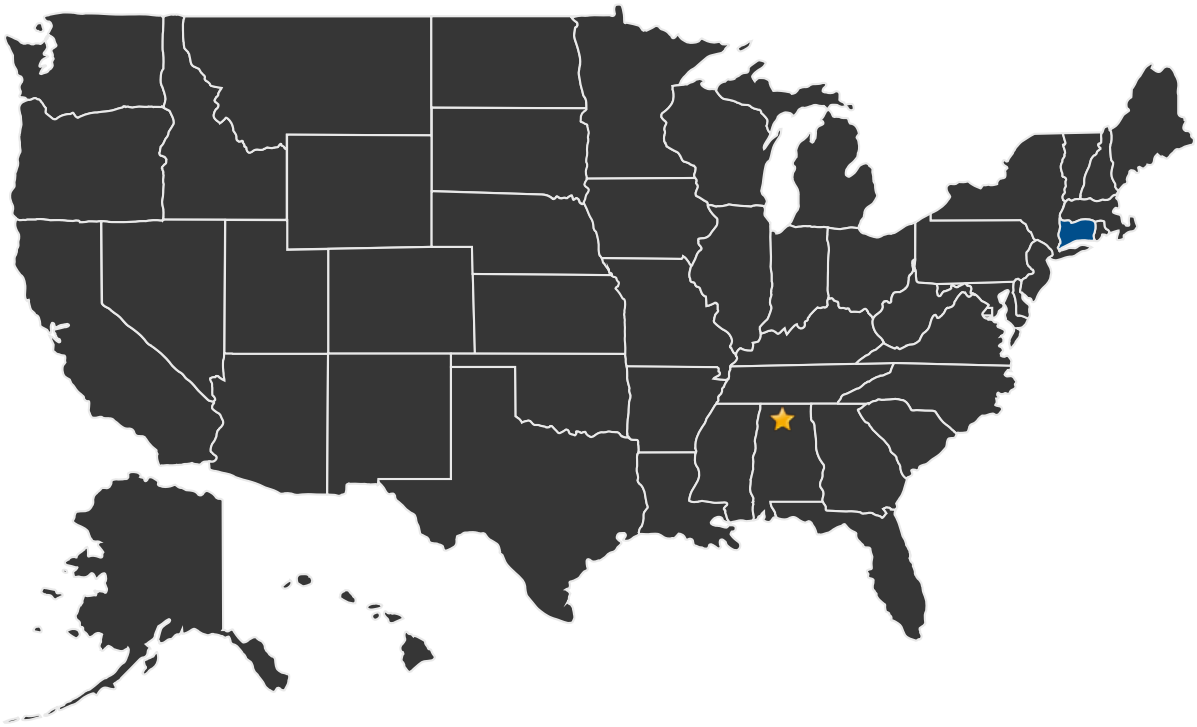
U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Marshall Space Flight Center

Other Organizations Performing Work:

- Proton Energy Systems, Inc. (Wallingford, CT)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/18055)

DETAILS FOR TECHNOLOGY 1

Technology Title

High Pressure Oxygen Generation for Future Exploration Missions